

New records of pollinating flies (Diptera: Bombyliidae, Mythicomysiidae, Syrphidae, and Conopidae) from Slovakia

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Abstract. Eleven species of flies from four families are recorded as new for the fauna of Slovakia: the bee flies (Bombyliidae) *Apolysis szappanosi* Papp, 2005, *Bombylisoma unicolor* (Loew, 1855), and *Lomatia lachesis* Egger, 1859; the micro bee fly (Mythicomysiidae) *Platypygus bellus* Loew, 1869; the hoverflies (Syrphidae) *Callicera aurata* (Rossi, 1790), *C. spinolae* Rondani, 1843, *Eumerus hungaricus* Szilády, 1940, *Myolepta potens* (Harris, 1780), *Paragus tibialis* (Fallén, 1817), and *Riponnensia splendens* (Meigen, 1822); and the thick-headed fly (Conopidae) *Zodion nigrirarsis* (Strobl, 1902).

Key words. Biodiversity, bioinventory, conservation, distribution

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INTRODUCTION

In addition to bees, hoverflies (Syrphidae) are among the most appreciated pollinators (Doyle et al. 2020), but other fly families, which also contribute to flower pollination, are often overlooked (Larson et al. 2001). Recognition of the role of wild pollinators (Breeze 2011; Garibaldi et al. 2013; Reily et al. 2024) and the decrease of flying insects in western Europe (Biesmeijer et al. 2006; Hallman et al. 2017; Seibold et al. 2019) has stimulated the production of first European level Red Lists of wild bees (Nieto 2014) and hoverflies (Vujić et al. 2022) and monitoring projects, such as SPRING (Potts et al. 2020).

For proper monitoring and protection of pollinators, we need accurate and up-to date national check lists. The Slovak republic (as part of the former Czechoslovakia) has a long history of dipterological research, culminating in the *Diptera Slovenska* series (Čepelák et al. 1984, 1986). Since then, four check lists of Diptera of the Czech Republic and Slovakia have been published (Ježek 1987; Chvála 1997; Jedlička et al. 2006, 2009), which have gradually expanded the list of species known from Slovakia. Since the last version of the Diptera checklist, there have been several additions to the species lists of bee flies, hoverflies, and thick-headed flies. In Slovakia, there are currently known 52 species of bee flies (Čelechovský and Bosák 2009; Čelechovský 2011, 2016, 2019a, 2019b), one species of micro bee fly (Bosák 2009), 389 species of hoverflies (Reverté et al. 2023) and 51 species of thick-headed flies (Chvála 2009; Semelbauer and Grechová 2019; Semelbauer et al. 2023).

As a result of ongoing entomological research, we report here three species of bee flies, 1 species of mythicomysid fly, six species of hoverflies and 1 species of thick-headed fly for the first time from Slovakia. Apart from these additions to the bioinventory of Diptera in the country, these new records also expand the number of insects acting in pollination of flowering plants in Slovakia. In addition, these records contribute also to precision of areas of distribution of these (in Central Europe) rare species.

METHODS

The insects were collected by means of Malaise trap in a sand dune near Virt in 2019, and individually or by netting over the vegetation in years 2015–2023. The specimens were pinned (pin size 1 or 000) or were glued to cardboard triangles. The images were taken using a Leica M205C binocular microscope or directly in the field. Living adult of *Callicera spinolae* Rondani, 1843 was photographed in a special box by means of a Canon EOS



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6D Mark II digital camera with a macro lens (Canon MP-E 65 mm 1–5×) and ring macro flash (Canon MR-14EX). The voucher specimens are deposited in the collection of the first author at the Institute of Zoology SAS (voucher numbers with the abbreviation UZSAV) unless mentioned otherwise.

RESULTS

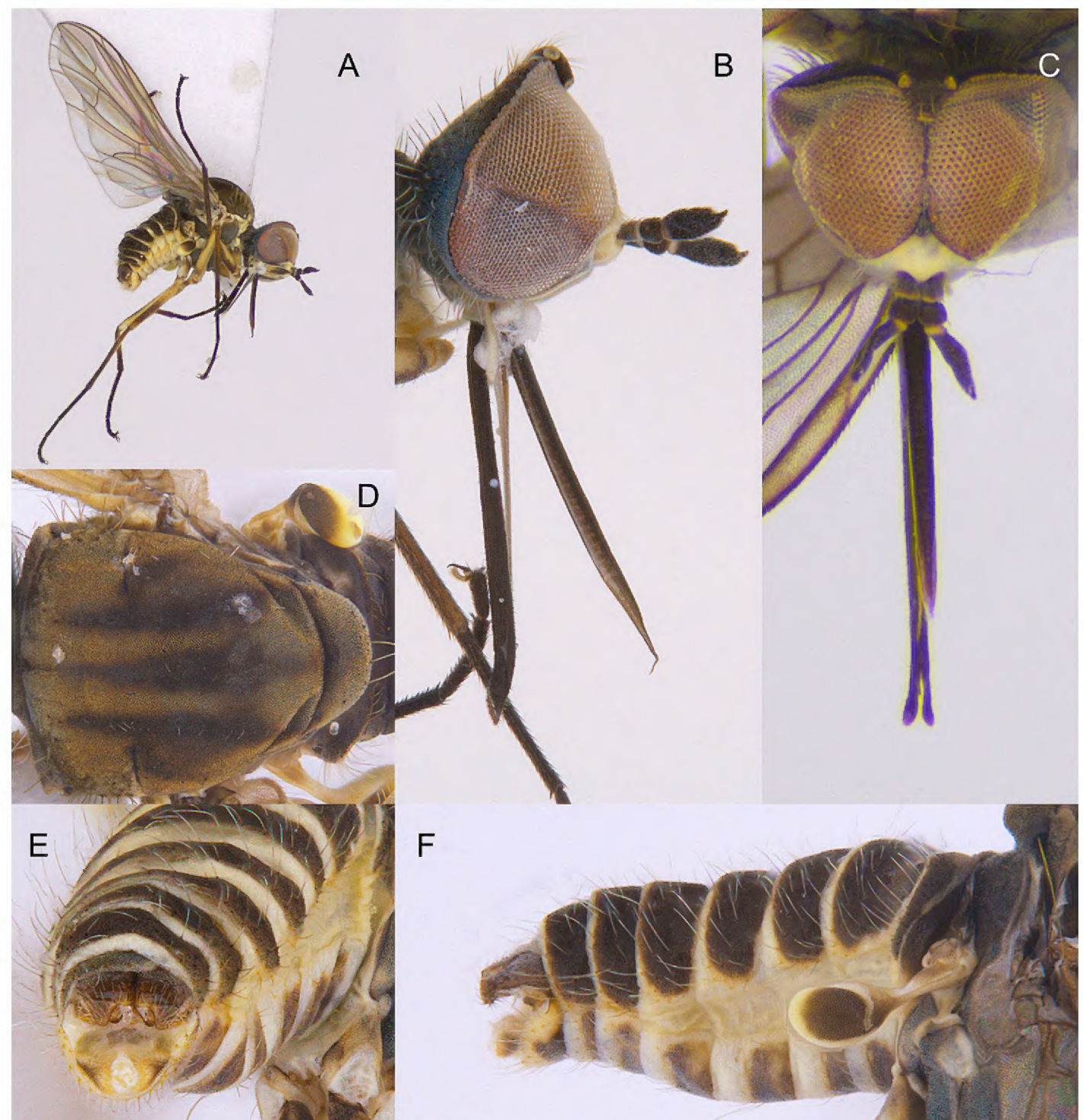
Family Bombyliidae

Apolysis szappanosi Papp, 2005

Figures 1–3, 24A, B

Material examined. SLOVAKIA – BRATISLAVA REGION • Malacky, Military district; 48°25′02.00″N, 017°04′15.70″E; 190 m alt.; 17.VI.2022; M. Semelbauer leg.; sand dune, net sweeping; 3♂, UZSAV 315 • Láb; 48°21′21.60″N, 016°57′04.80″E; 143 m alt.; 6.VI.2023; M. Semelbauer leg.; meadow with flowering *Potentilla* L., net sweeping, 3♂, 1♀, pinned and deposited in SMOC (= Silesian Museum, Opava, Czech Republic), d 043 11-2024 • Jakubov; 48°24′30.60″N, 016°55′12.03″E; 143 m alt.; 15.V.2024; M. Semelbauer leg.; fallow, net sweeping, 3♂ UZSAV 316 • Malacky; 48°25′43.97″N, 017°01′56.72″E; 164 m alt.; 30.V.2024; M. Semelbauer leg.; ruderal site, net sweeping, 1♂, pinned and deposited in SMOC, d 043 11-2024 – TRNAVA REGION • Čáry; 48°39′16.52″N, 017°05′02.00″E; 166 m alt.; 7.VI.2024; M. Semelbauer leg.; fallow, net sweeping, 1♀, UZSAV 317 – NITRA REGION • Virt, garden; 47°45′43.80″N, 18°20′23.90″E; 114 m alt.; 5.VI.2018; M. Kozánek, J. Kodada leg.; sand dune, Malaise trap; 5♀, UZSAV 318 • ibid., 14.VI.2018, 11♀, UZSAV 319 • ibid., 18.VI.2018, 1♂, UZSAV 320 • Virt, forest; 47°45′38.00″N, 018°20′14.30″E; 114 m alt.; 30.V.2018; M. Kozánek, J. Kodada leg.; sand dune, Malaise trap; 1♂, UZSAV 321 • ibid., 11.V.2018, 1♀, UZSAV 322 • Virt; 47°45′39.10″N, 018°20′02.80″E; 110 m alt.; 22.5.2022; M. Semelbauer leg.; sand dune, net sweeping; 3♂, UZSAV 323 • Virt, old winery; 47°45′37.57″N, 018°20′5.94″E; 114 m alt.; 30.V.2018; L. Vidlička, O. Majzlan leg.; sand dune, Malaise trap; 1♂, 15♀, UZSAV 323 • Marcelová; 47°47′53.60″N, 018°16′07.00″E; 119 m alt.; 11.VI.2023; M. Semelbauer leg.; eolian sand deposit, net sweeping, 3♂, 4♀, UZSAV 324.

Figure 1. *Apolysis szappanosi* male. **A.** habitus, lateral view. **B.** Head, lateral view. **C.** head, dorsal view. **D.** Thorax, dorsal view. **E.** Abdomen, posterior view. **F.** Abdomen, lateral view.



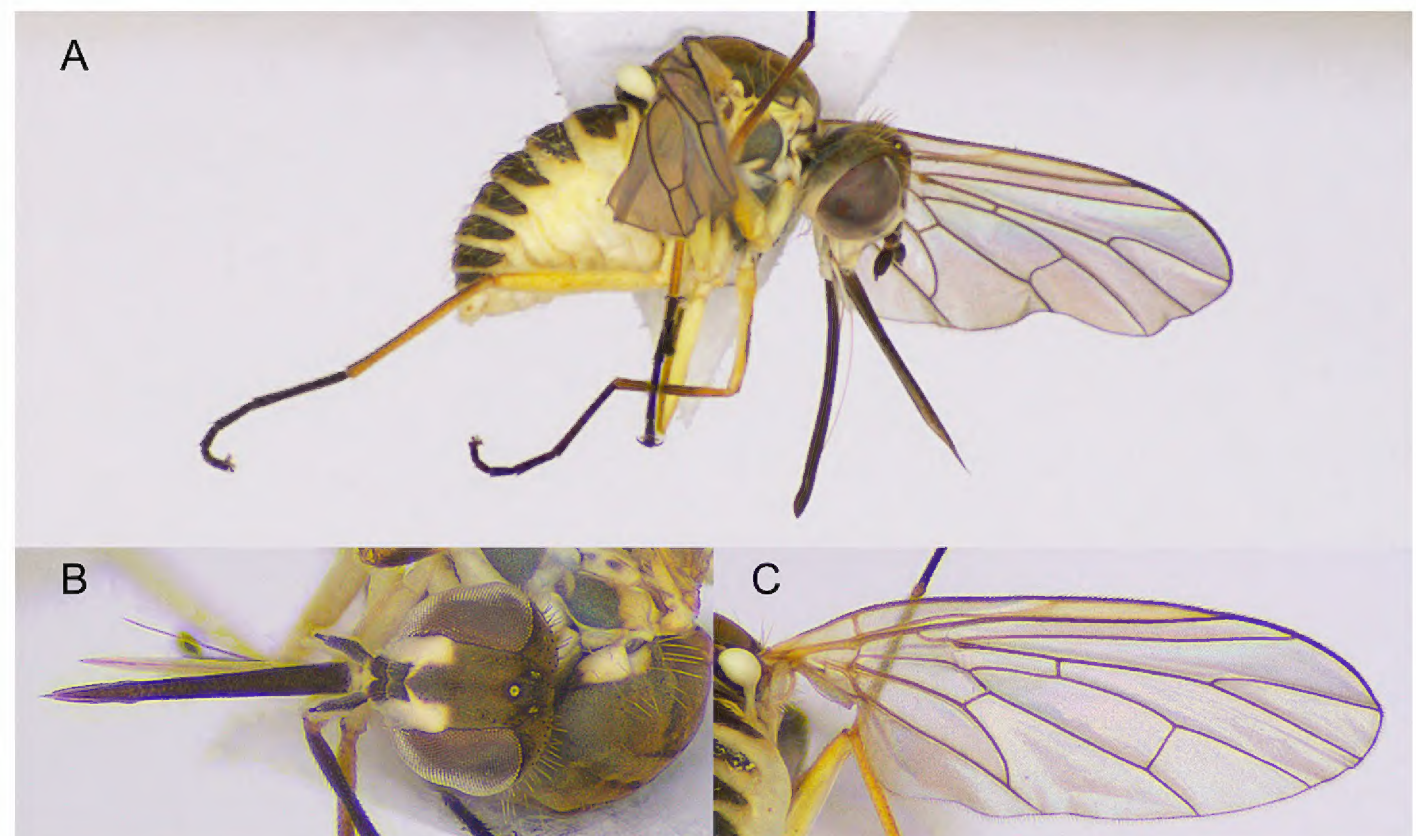
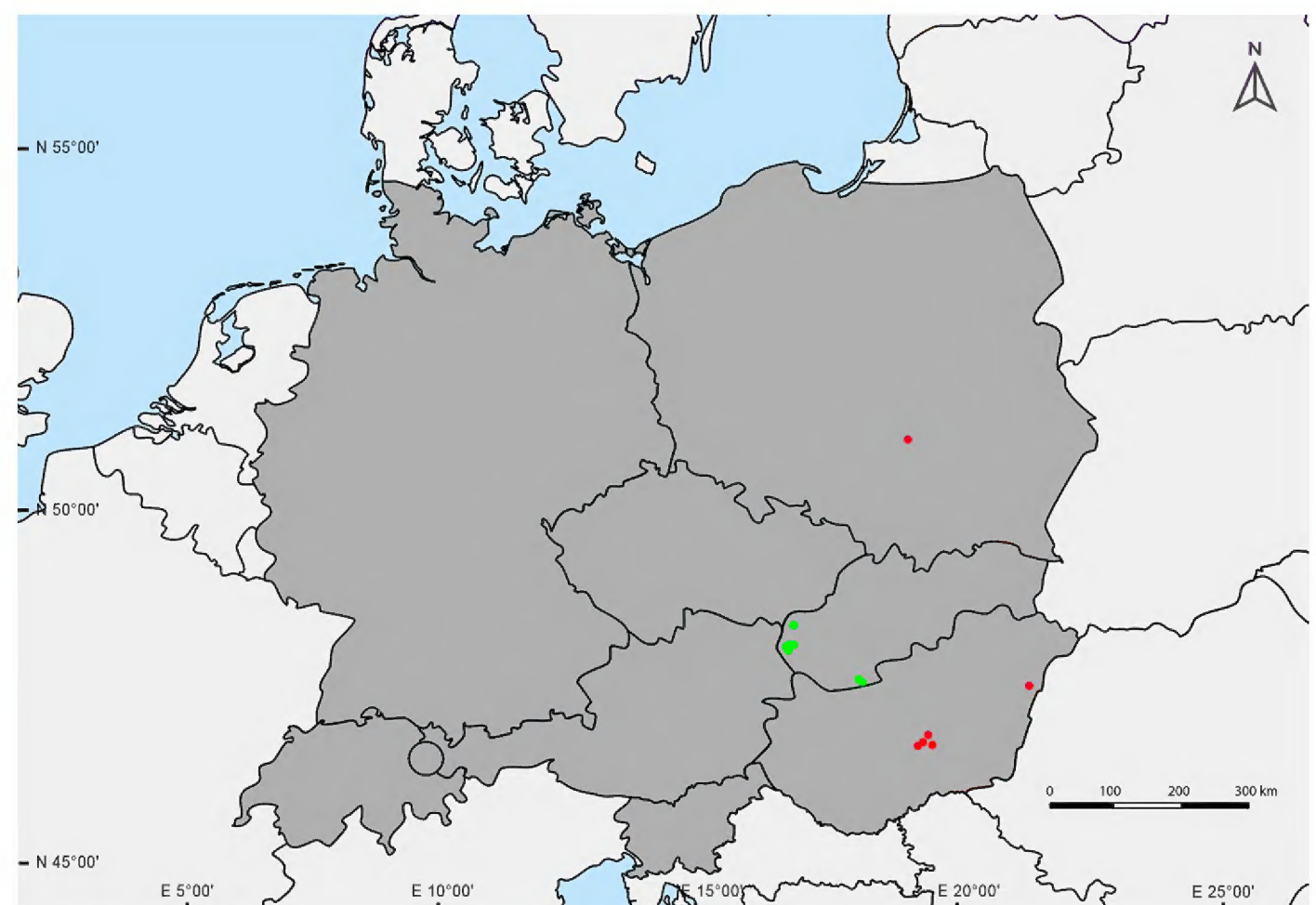


Figure 2. *Apolysis szappanosi* female. **A.** Habitus, lateral view. **B.** Head, dorsal view. **C.** Wing, dorsal view.

Figure 3. Geographic distribution of *Apolysis szappanosi* in Central Europe. Known occurrence (red circle). New records (green circle). Data from: iNaturalist (2024a), Papp (2005), Mielczarek (2018).



Identification. This is a tiny fly, less than 3 mm long, and with a rather long proboscis. Species of this genus share specific structure of antenna, a subapical excavation with two styles (Evenhuis 1990). Only a few species of the genus *Apolysis* occur in Europe, and most of these are known from the Mediterranean region except for *A. eremophila* Loew, 1873, which has been reported from Hungary. This information comes from Thalhammer, but Papp (2005) considered it unreliable, even for inclusion in the genus. Moreover, the voucher specimen was destroyed in a fire at the Hungarian Natural History Museum in 1956. Papp (2005) recommended deleting *A. eremophila* from the Hungarian checklist. *Apolysis eremophila* clearly differs from *A. szappanoszi* in having the discal cell open (Gharali et al. 2010). Within Slovakia, *A. szappanoszi* can be externally confused only with some small Mythicomyiidae, Hybotidae, or Empididae.

***Bombylisoma unicolor* (Loew, 1855)**

Figures 4, 5, 24D

Material examined. SLOVAKIA – BRATISLAVA REGION • Čiližská Radvaň; 47°50'36.50"N, 017°42'08.70"E; 108 m alt.; 19.VII.2023; M. Semelbauer leg.; fallow, net sweeping, 1♀, UZSAV 325 • Láb; 48°20'38.90"N, 016°57'11.00"E; 144 m alt.; 6.VII.2023; M. Semelbauer leg.; fallow, net sweeping, 1♀, UZSAV 326 • Malé Leváre, Rudava recreation area; 48°29'33.90"N, 16°57'51.00"E; 149 m alt.; 6.VII.2021; M. Semelbauer leg.; fallow, net sweeping; 1♀, UZSAV 327 • Senec, landfill; 48°14'52.30"N, 017°23'01.50"E; 141 m alt.; 16.VI.202; M. Semelbauer leg.; ruderal vegetation on loam, net sweeping; 1♂, 1♀, UZSAV 328 • Svätý Jur, Šúr; 48°14'12"N, 017°14'00"E; 130 m alt.; 24.VI.1963; H. Vlčková leg., A. Čelechovský redet.; fallow, net sweeping, 1♂, 1♀ UPO448 – NITRA REGION • Komárno, Apálsky



Figure 4. *Bombylisoma unicolor*. **A.** habitus, male, lateral view. **B.** male, dorsal view. **C.** head, male, lateral view. **D.** Head, male, dorsal view. **E.** head, female, lateral view. **F.** head, female, dorsal view.

Figure 5. Geographic distribution of *Bombylisoma unicolor* in Central Europe. Known occurrence (red circle). New records (green circle). Data from: Čelechovský and Čelechovský (2023), iNaturalist (2024b), Tóth (1978).



ostrov island; 47°47'11.30"N, 018°07'44.00"E; 108 m alt.; 17.VI.2021; M. Semelbauer leg.; fallow, net sweeping; 1♀, UZSAV 329. – TRNAVA REGION • Dechtice, 48°33'31.30"N, 017°34'40.10"E; 236 m alt.; 27.VI.2023; M. Semelbauer leg.; dry meadow and scrub; net sweeping; 9♀, UZSAV 330 • Dolný Lopašov; 48°35'16.70"N, 017°38'05.80"E; 243 m alt.; 26.V.2022; M. Semelbauer leg.; net sweeping; 1♂, UZSAV 331 • Holíč; 48°48'14.80"N, 017°07'10.40"E; 156 m alt.; 29.VI.2021; M. Semelbauer leg.; dirt road, net sweeping; 1♀, UZSAV 332.

Identification. The laterotergite is hairy and cell r_5 is open or closed on the wing margin. Only two species of the genus *Bombylisoma* Rondani, 1856 that have yellow abdominal tergites with long protruding setae have been recorded from Slovakia. *Bombylisoma nigriceps* (Loew, 1862) has transparent wings, and males have distinctive black hair on their heads. *Bombylisoma minimum* (Scopoli, 1771) has darkened wings, and males are less pubescent, with yellow basal parts above the antennae. *Bombylisoma unicolor* has a yellow hairy abdomen without black hairs (Engel 1933; Zaitzev 1966; Greathead and Evenhuis 1997; El-Hawagry and Evenhuis 2008).

***Lomatia lachesis* Egger, 1859**

Figures 6, 7, 24D

Material examined. SLOVAKIA – TRNAVA REGION • Dolný Lopašov; 48°35'16.70"N, 017°38'05.80"E; 239 m alt.; 26.V.2022; M. Semelbauer leg.; net sweeping; 2♂, 3♀, UZSAV 333 • Lančár; 48°35'53.20"N, 017°38'57.70"E; 239 m alt.; 26.V.2022; M. Semelbauer leg.; net sweeping; 6♂, 1♀, UZSAV 334 • Šaštín-Stráže, Gazárka; 48°37'17.70"N, 017°08'20.88"E; 200 m alt.; 3.VI.2015; A. Čelechovský leg.; forest clearing along the road, sweeping the net; 1♀, UPO 623.

Identification. Only three species of the genus *Lomatia* Meigen, 1822 have been recorded from Slovakia so far, and all of them have a black abdomen with a hind margin of tergites yellow. *Lomatia lachesis* can be relatively easily recognized by the brown to black sternites; all other species have 1–3 reddish sternites. Males of *L. lachesis*

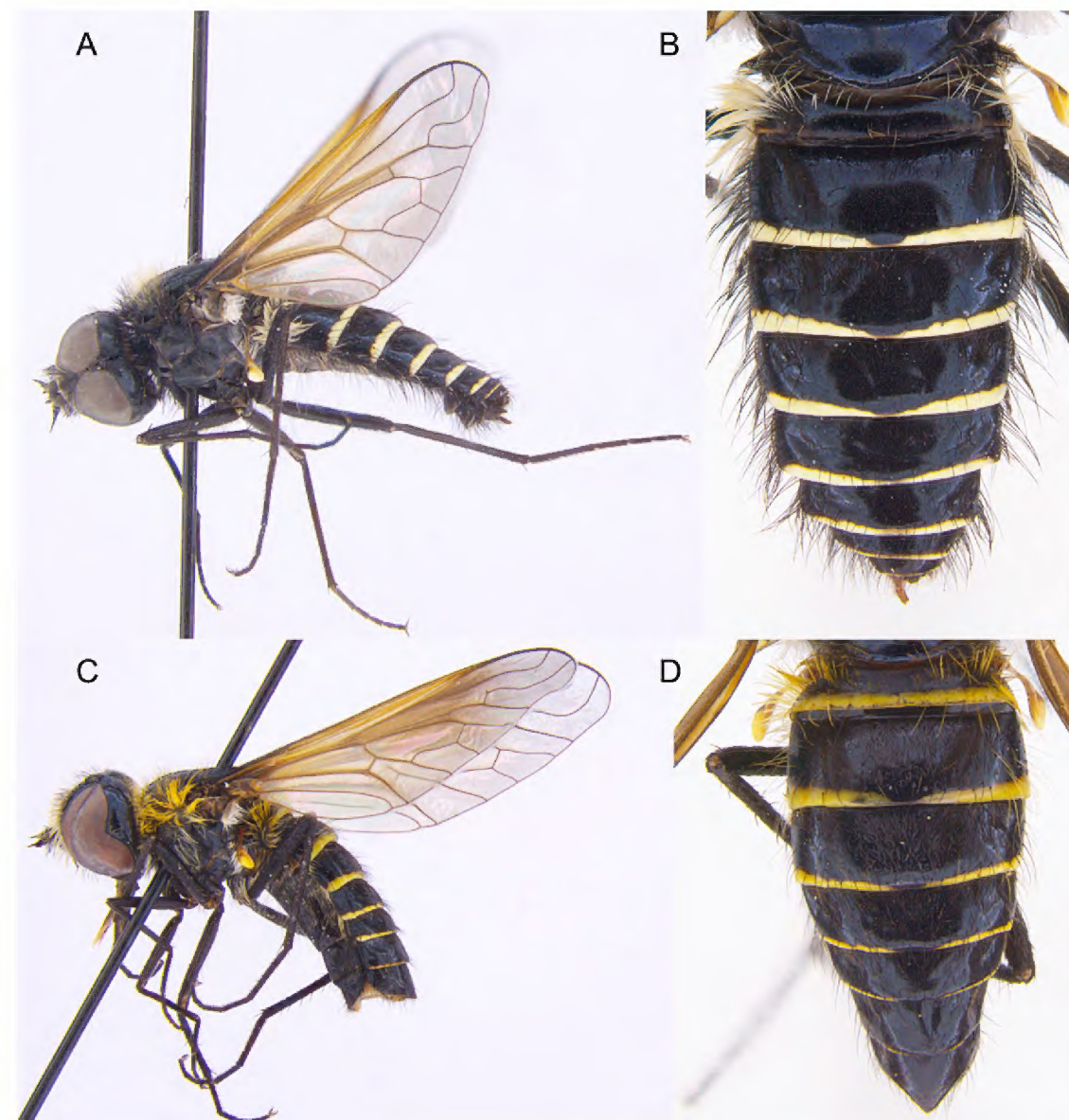


Figure 6. *Lomatia lachesis*. **A.** Male, habitus, lateral view. **B.** male, abdomen, dorsal view. **C.** Female, habitus, lateral view. **D.** Female, abdomen, dorsal view.

Figure 7. Geographic distribution of *Lomatia lachesis* in Central Europe. Known occurrence (red circle). New records (green circle). Data from: Čelechovský (2013), Franz (1989), Tóth (1978), Schlüssmayr (2018, 2021).



differ from males of *L. erynnis* Loew, 1869 in having only black hairs on abdominal tergites (predominantly white hairs in *L. erynnis*), from males of *L. lateralis* (Meigen, 1820) by the presence of black hairs on the prosternum and a completely black first tergite (prosternum with white hairs and first tergite with yellow hind margin in *L. lateralis*), and from males of *L. sabaëa* (Fabricius, 1781) in having white hairs on first tergite and squama allaris (reddish hairs on the first tergite and black hairs on squama allaris in *L. sabaëa*).

Females of *L. lachesis* are similar to *L. erynnis*, but they have light hairs predominant on mesonotum and scutellum. Females of *L. lateralis* differ by bright orange sides of the second and third tergites. Females of *L. sabaëa* are distinctly larger, with striking dense and long red hairs on thorax and first abdominal tergite (Zaitzev 1966; Tóth 1977).

Family Mythicomyiidae

According to genomic studies of Li et al. (2021), this taxon is placed as a subfamily of Bombyliidae.

***Platypygus bellus* Loew, 1869**

Figures 8, 9, 24A, B

Material examined. SLOVAKIA – BRATISLAVA REGION • Malacky; 48°25'02.00"N, 017°04'15.70"E; 189 m alt.; 17.VI.2019; M. Semelbauer leg.; sand dune, net sweeping; 3♀, pinned, UZSAV 335 • ibid., 18.VI.2019; 2♀, pinned, UZSAV 336 • ibid., 18.VI.2020, 3♂, 2♀, pinned, UZSAV 337 • ibid., 25.VI.2020, 1♂, 1♀, pinned and deposited in SMOC, d 04111-2024.

Figure 8. *Platypygus bellus*, female. **A.** Habitus, lateral view. **B.** Head, dorsal view. **C.** Thorax, dorsal view. **D.** wing. **E.** Abdomen, dorsal view. **F.** Terminalia, posterior view.

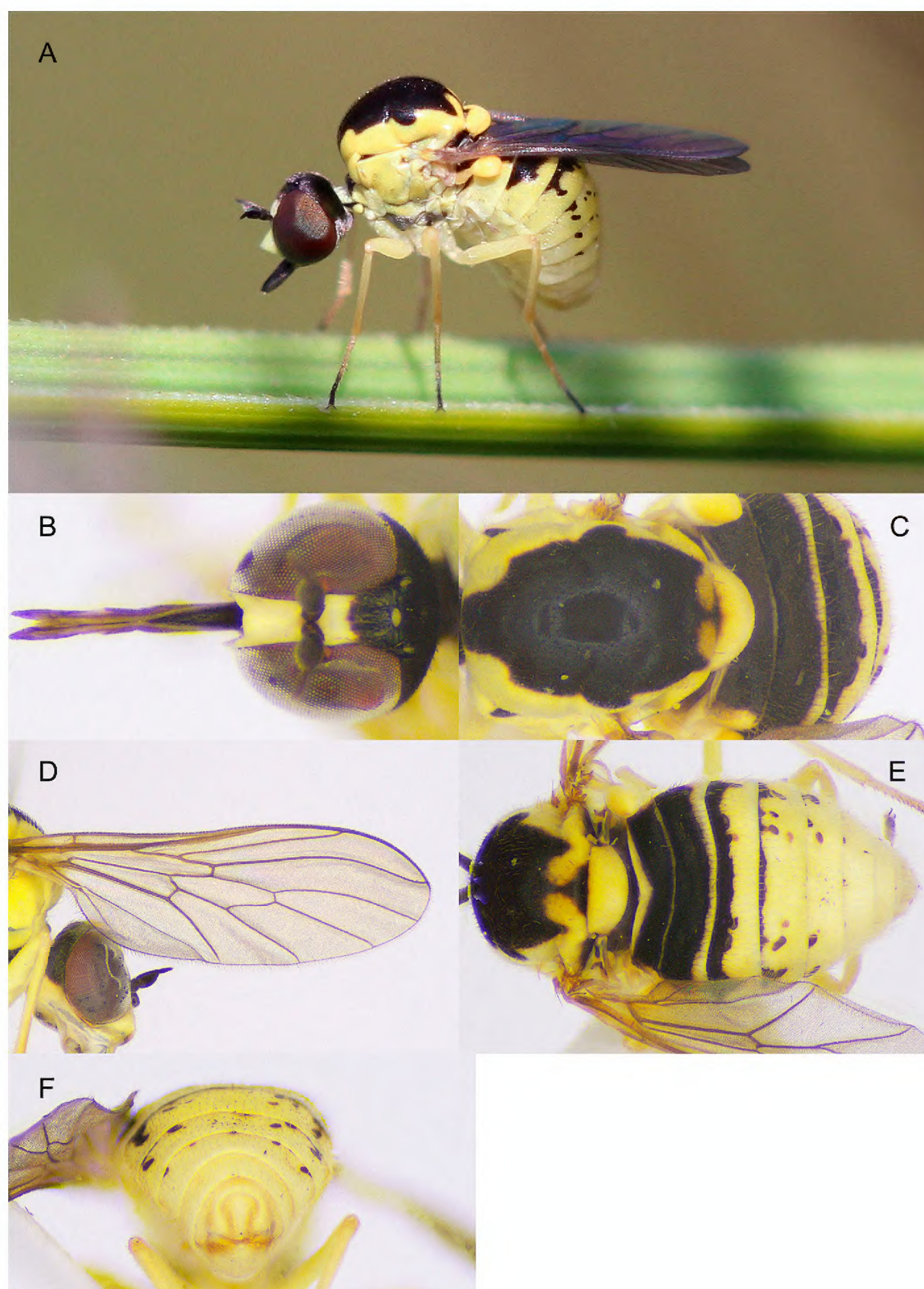
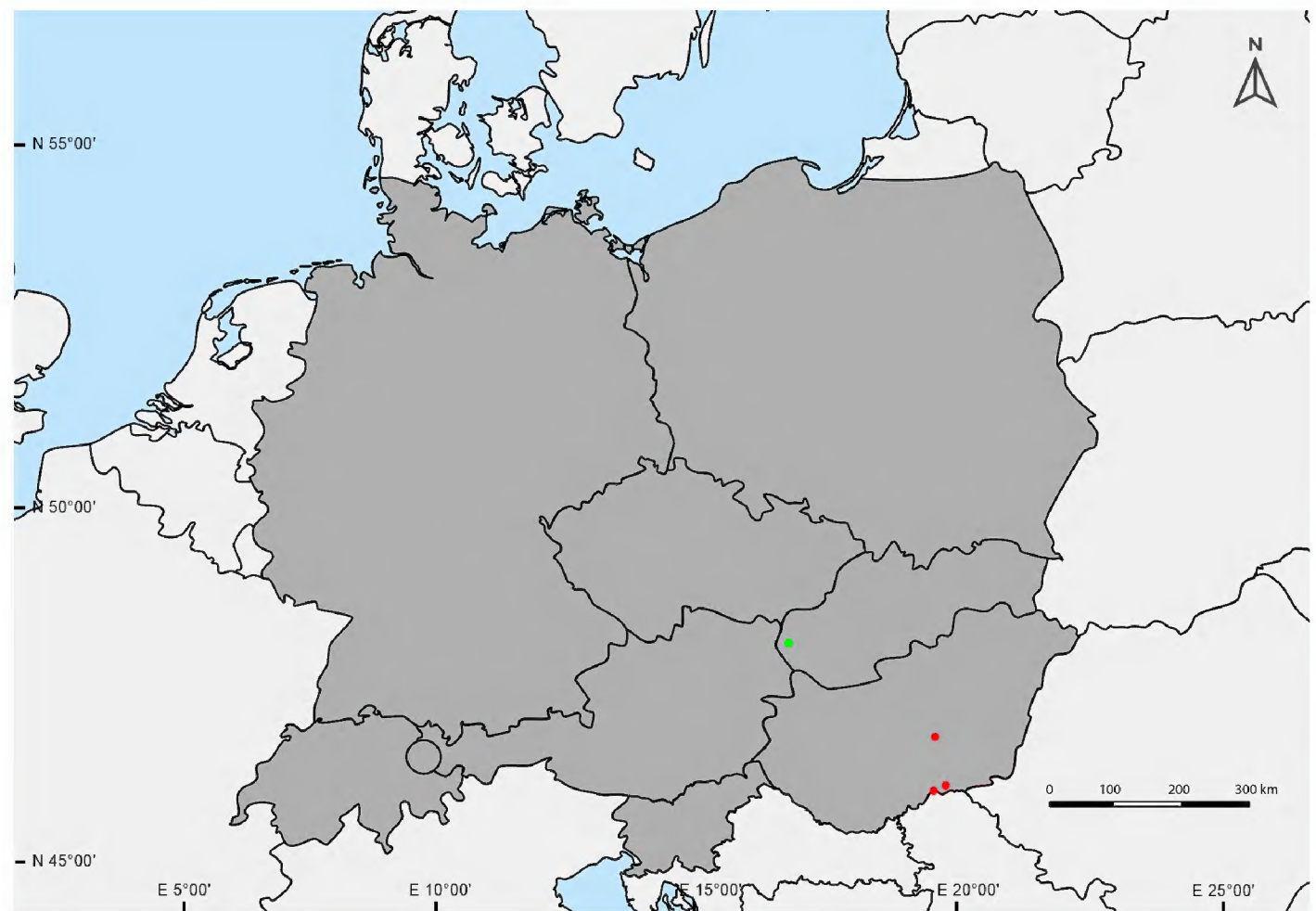


Figure 9. Geographic distribution of *Platypygus bellus* in Central Europe. Known occurrence (red circle). New records (green circle). Data from: Papp (2003), Gyurkovics (2019).



Identification. In Europe, only four species of *Platypygus* Loew, 1844 occur, but only *P. bellus* extends to Central Europe. Within the Slovak fauna, *P. bellus* is fairly easy to recognize by its small size, contrasting black and yellow colour, and a unusual, stooped appearance. From species of *Cyrtosia* Perris, 1839, it differs by having the dm cell closed. From other species of *Platypygus* it is distinguished by the large black mark on mesonotum, which extends in a triangular patch in the prescutellar area (Gharali et al. 2013).

Family Syrphidae

***Callicera aurata* (Rossi, 1790)**

Figures 10A, 11A, B, 12, 24D, E

Material examined. SLOVAKIA — BRATISLAVA REGION • Malacky, Castle Park; 48°26'11.20"N, 017°02'02.20"E; 169 m alt.; 14.X.2023; M. Semelbauer leg.; individual collection on flowering ivy, 1♀, pinned, UZSAV 338.

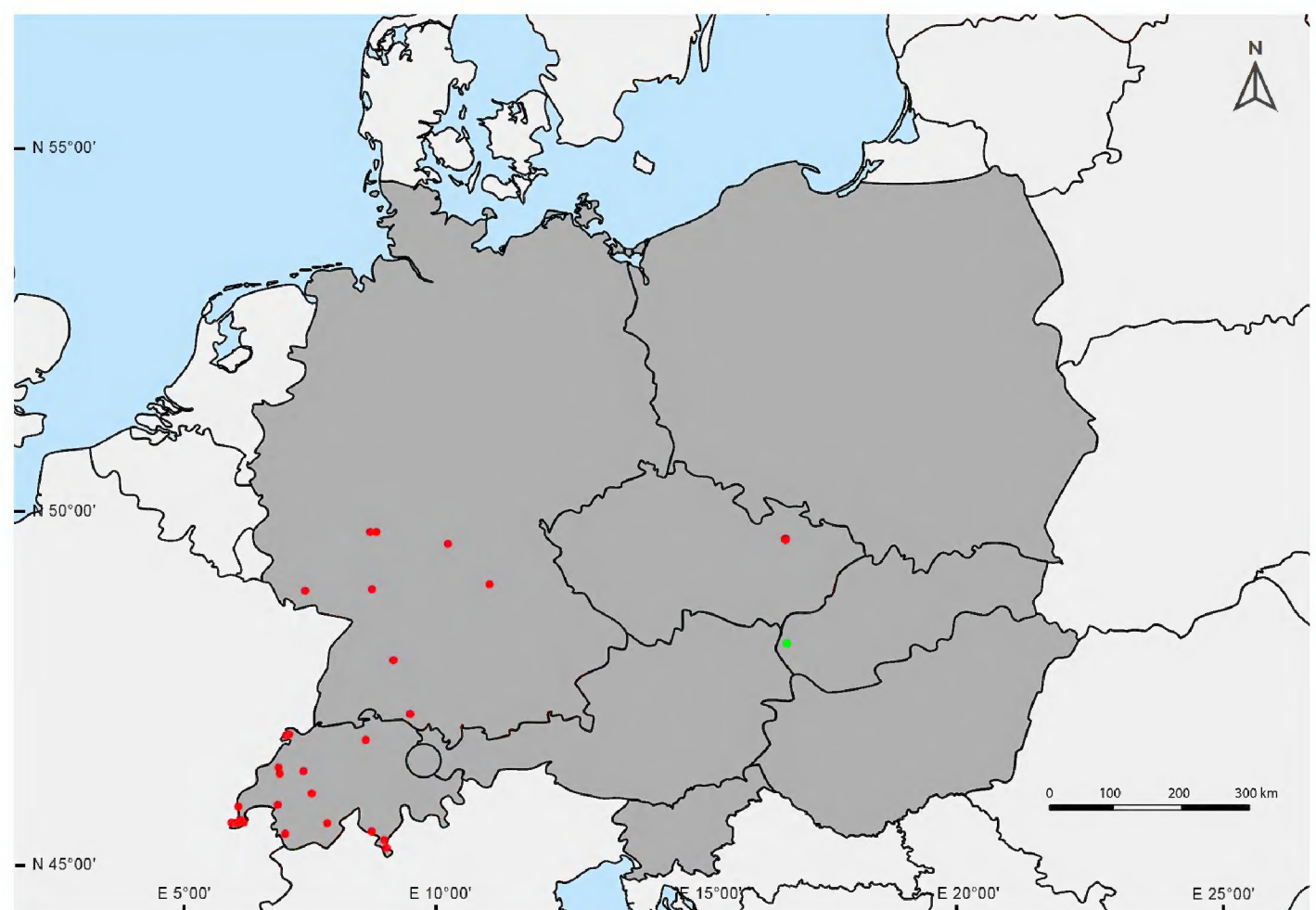
Figure 10. **A.** *Callicera aurata* on ivy blossom, Malacky. **B.** *Callicera spinolae* on ivy blossom, Malacky. **C, D.** *Callicera spinolae* from Chrámec.





Figure 11. *Callicera* species, pinned. **A.** *Callicera aurata*, habitus, lateral view. **B.** *C. aurata*, thorax, dorsolateral view. **C.** *C. spinolae*, habitus, lateral view. **D.** *C. spinolae*, thorax, dorsolateral view.

Figure 12. Geographic distribution of *Callicera aurata* in Central Europe. Known occurrence (red circle). New records (green circle). Data from: iNaturalist (2024c), Král and Mazánek (2023), Plichta and Fisler (2021).



Identification. The genus *Callicera* Panzer, 1806 was represented in Slovakia by single species, *C. aenea* (Fabricius, 1777). In Europe, there are six species of *Callicera*. From these species, *C. aurata* can be recognized by following combination of characters: postpedicel about as long as scapus and pedicel together, femora extensively black and thorax entirely shining with two distinct, medial, longitudinal dust-stripes, ending abruptly between the wing bases (Smit 2014). The dust stripes on scutum of our specimen are invisible; therefore, we need additional characters to distinguish it from *C. aenea*. In *C. aurata*, the scutellar hairs are nowhere as long as the scutellum, the pleura is black-haired ventrally, the fore femora are extensively black-haired posterolaterally, and tarsal segments 3–5 are almost black. In contrast, tarsal segments in *C. aenea* are much paler (van Veen 2010).

***Callicera spinolae* Rondani, 1843**

Figures 10B, D, 11C, D, 13, 24D–F

Material examined. SLOVAKIA – BRATISLAVA REGION • Malacky, Castle Park; 48°26'11.20"N, 017°02'02.20"E; 169 m alt.; 14.X.2023; M. Semelbauer leg.; individual collection on flowering ivy, 2♀, pinned and observed, UZSAV 339 – RÍMAVSKÁ SOBOTA REGION • Chrámec 3 km SW, Vlčia dolina; 48°15'57"N, 020°09'08"E; 205 m alt.; 12.X.2023; J. Ševčík K. and Sopuch leg., J. Roháček det., netted from flowering yarrow on pasture meadow, 1♀, pinned and deposited in SMOC, d 078 1-2023.

Identification. From other species of *Callicera*, *C. spinolae* can be distinguished by following combination of characters: postpedicel about as long as scapus and pedicel together, femora of female completely orange and third abdominal tergite with a complete, dull transverse band (Smit 2014).

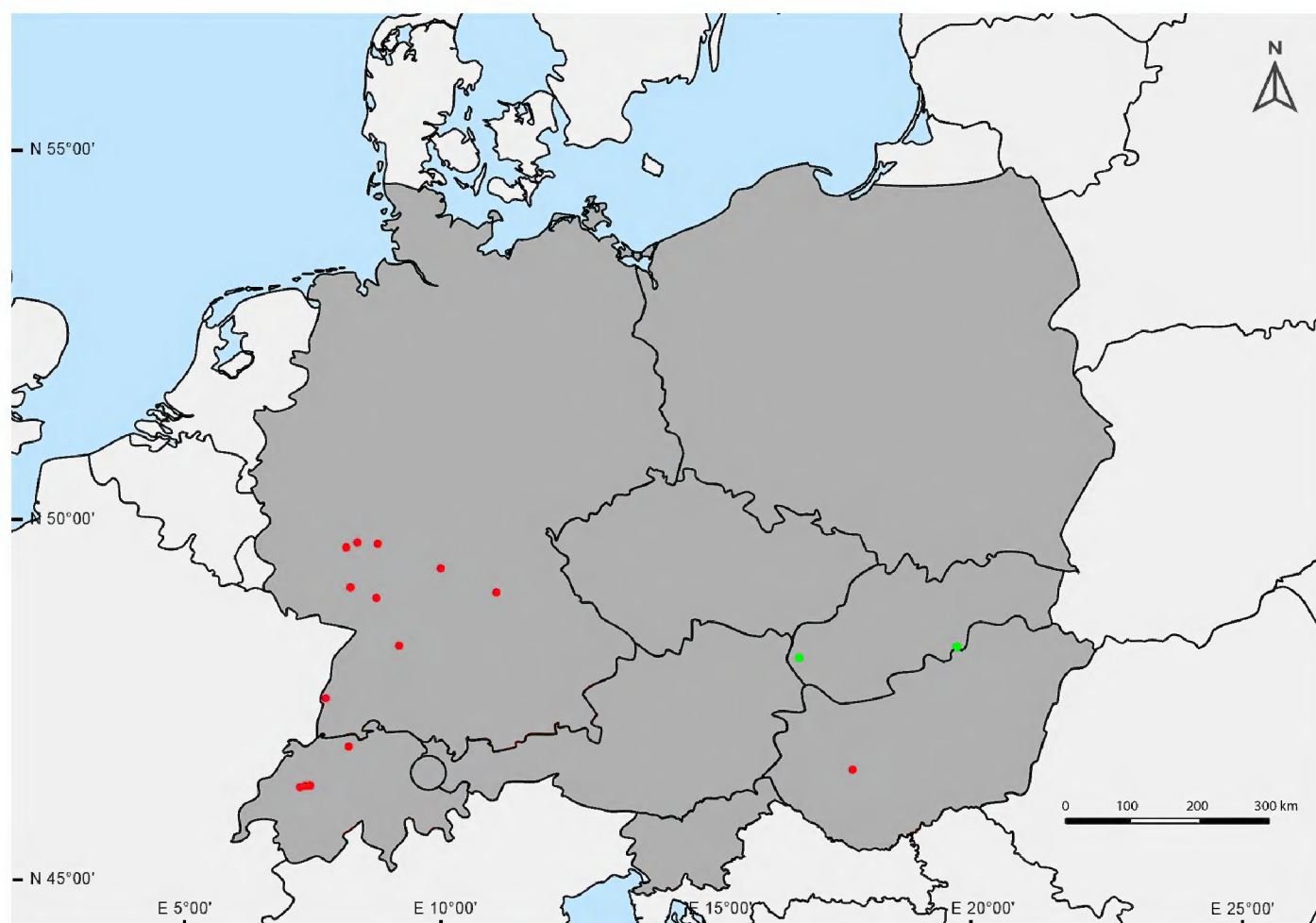


Figure 13. Geographic distribution of *Callicera spinolae* in Central Europe. Known occurrence (red circle). New records (green circle). Data from: iNaturalist (2024d), Plichta and Fisler (2021), Tóth (2011).

***Eumerus hungaricus* Szilády, 1940**

Figures 14, 15, 25C

Material examined. SLOVAKIA — NITRA REGION • Virt; garden; 47°45'43.80"N, 018°20'23.90"E; 114 m alt.; 27.VII.2018; sand dune, Malaise trap; 1♂, UZSAV 340 • Salka, Sovie vinohrady nature reserve; 47°53'13.80"N, 018°43'02.00"E; calcareous grassland; 121 m alt.; 10.VI.2023; net sweeping; 1♀, UZSAV 341.

Identification. *Eumerus hungaricus* can be distinguished by following combination of characters: abdomen black with whitish dust spots, postpedicel redish in ventral surface, male: in tergite3 and 4, long white incurving

Figure 14. *Eumerus hungaricus*. **A.** Male, habitus, lateral view. **B.** Male, dorsal view. **C.** female, habitus, lateral view. **D.** Female, thorax, dorsal view. **E.** female, abdomen, dorsal view.

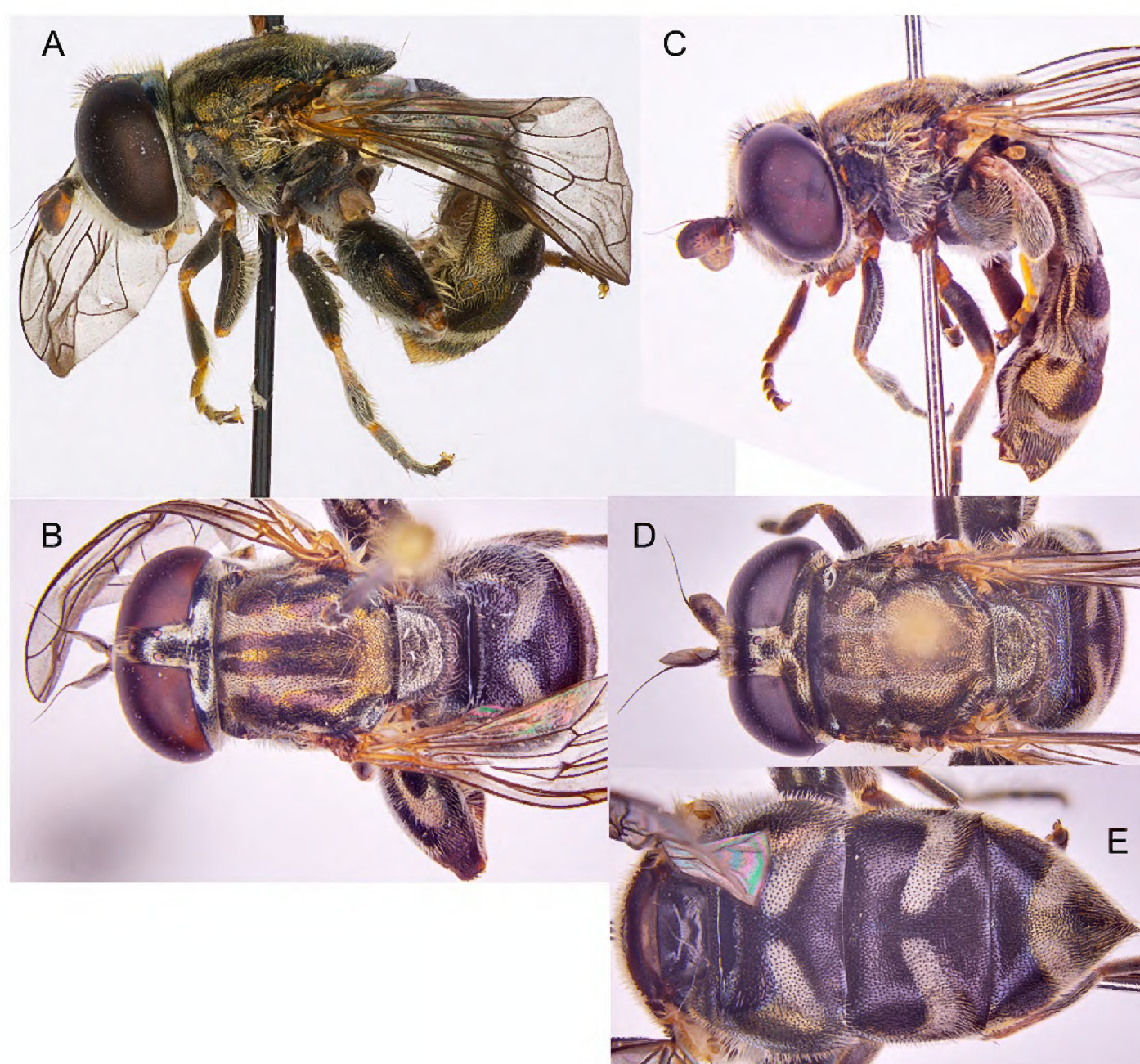


Figure 15. Geographic distribution of *Eumerus hungaricus* in Central Europe. Known occurrence (red circle). New records (green circle). Data from: Ricarte et al. (2017), Tóth (2011).



hairs present along lateral margin, hind femur swollen, on ventral surface with fringe of long white hairs, hind tibia with subapical clump of dark hairs (Figures 14, 15). Separation of females remains problematic, however, but the larger size (8.5–9.5 mm; Speight et al. 2021) of *E. hungaricus* provides a useful hint. Following the key of van Veen (2010), *E. hungaricus* female would key out as *E. ornatus* Meigen, 1822 or *E. ruficornis* Meigen, 1822. *Eumerus ornatus* females can be easily distinguished by apparent suture running along the notopleural callus (Speight et al. 2021); *E. ruficornis* females should be distinguished by bright reddish antennae. According to Speight et al. (2021), *E. hungaricus* females cannot be reliably separated from *E. pulchellus* Loew, 1848, but the distribution of *E. pulchellus* is restricted to the Mediterranean region (Canary Islands, Southern Europe, North Africa, Turkey; Barkalov et al. 2018), and its presence in Central Europe is unlikely.

***Myolepta potens* (Harris, 1780)**

Figures 16, 17, 25B

Material examined. SLOVAKIA – BRATISLAVA REGION • Svätý Jur, Šúr Nature reserve; 48°13'32.50"N, 017°12'35.90"E; 134 m alt.; 8.VI.2023; individual collection on a damaged and hollowed *Acer campestre* L., 1♀, pinned, UZSAV 342.

Figure 16. *Myolepta potens*. **A.** Habitus, lateral view. **B.** head, frontal view. **C.** Abdomen, dorsal view.

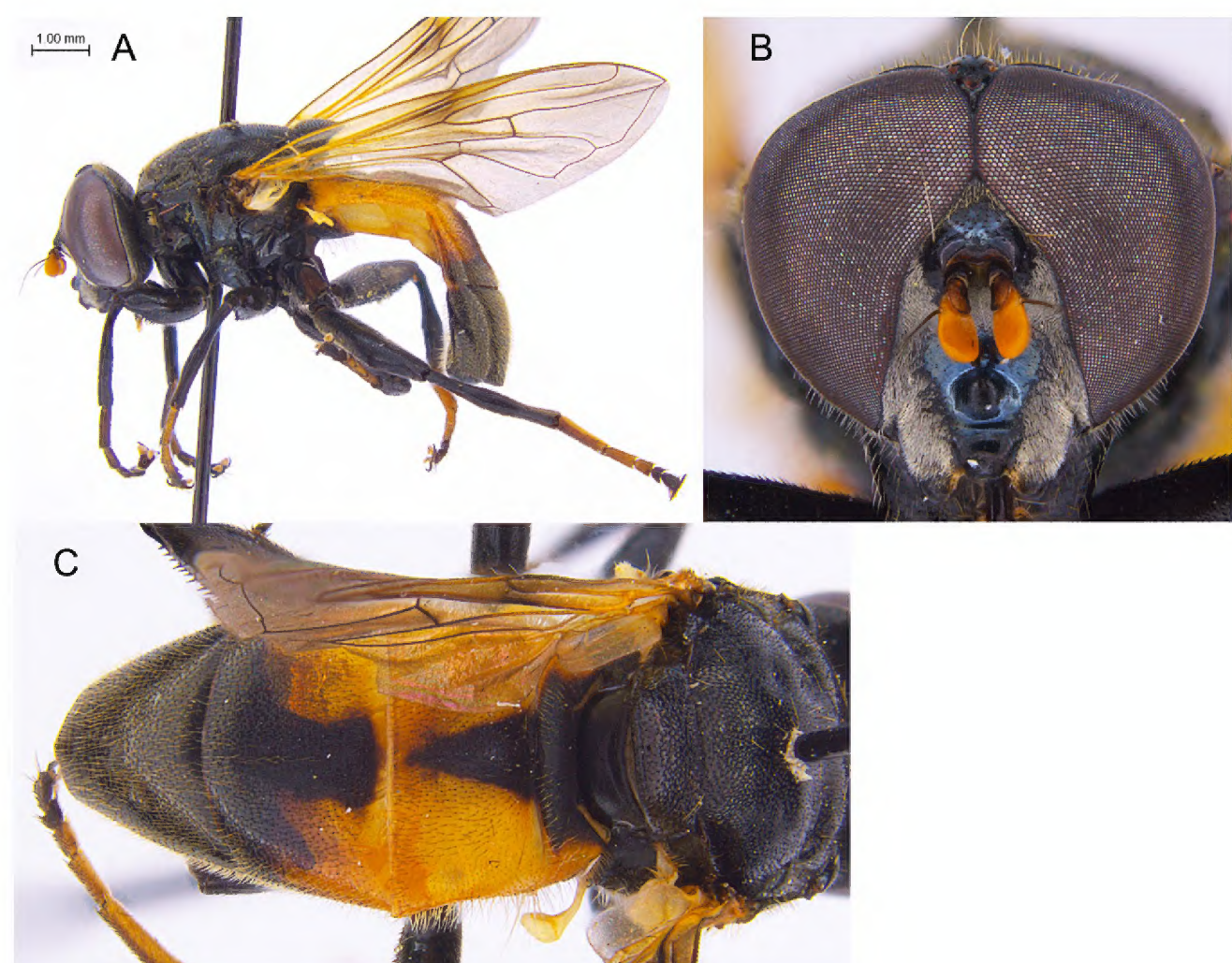




Figure 17. Geographic distribution of *Myolepta potens* in Central Europe. Known occurrence (red circle). New records (green circle). Data from: GBIF (2024a), Tóth (2011), Reemer et al. (2004)

Identification. Of three species of *Myolepta* Newman, 1838 recorded in Slovakia, only *M. dubia* (Fabricius, 1805) has orange markings on the abdomen similar to *M. potens*. These two species are possible to differentiate by the shape of the bare, shiny stripe on the face: in *M. potens* it is triangular, while in *M. dubia* it has roughly linear (Reemer et al. 2004).

***Paragus tibialis* (Fallén, 1817)**

Figures 18, 19, 25C

Material examined. SLOVAKIA – NITRA REGION • Virt, garden; 47°45'43.8"N, 018°20'23.9"E; 114 m alt.; 7.VI.2018; Kozánek and Kodada leg., Mazánek det., sand dune, Malaise trap; 1♂, pinned, UZSAV 343.

Figure 18. *Paragus tibialis*, male. **A.** Habitus, lateral view. **B.** Habitus, dorsal view.

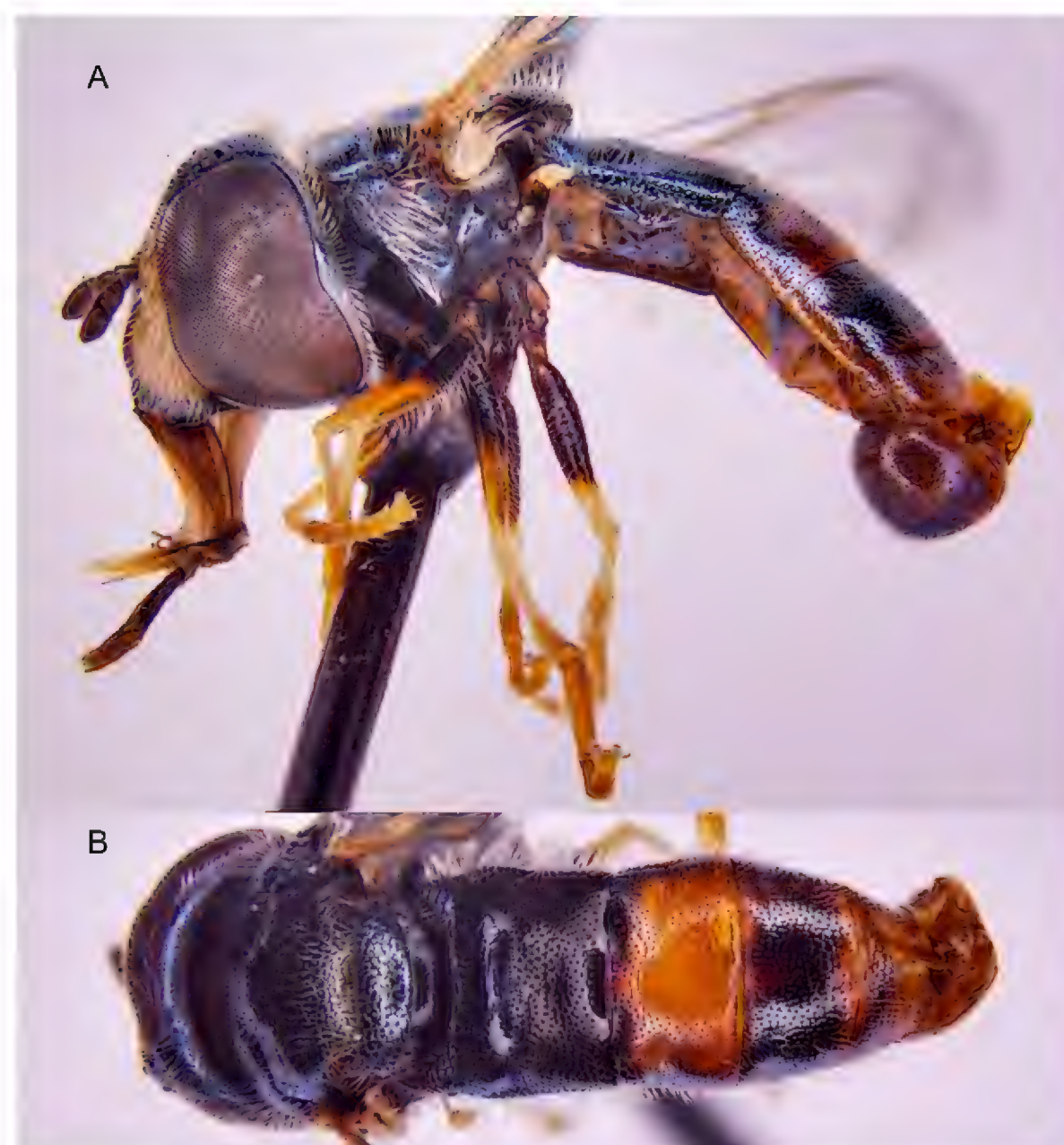




Figure 19. Geographic distribution of *Paragus tibialis* in Central Europe. Known occurrence (red circle). New records (green circle). Data from: GBIF (2024b), Tóth (2011).

Identification. Habitus identical to *P. haemorrhous* Meigen, 1822 and females indistinguishable. Males of *P. haemorrhous* have comparably smaller genitalia and sternite 3 is as long as sternite 4; in *P. tibialis* the genitalia are larger and sternite 4 is much shorter compared to sternite 3 (van Veen 2010). In *P. constrictus* (Šimić, 1986), parameres bear a keel on their inner side and an almost straight upper margin; in *P. tibialis*, the parameres lack a keel and have an up-curved upper margin (van Veen 2010).

***Riponnensia splendens* (Meigen, 1822)**

Figures 20, 21

Materials examined. SLOVAKIA – BRATISLAVA REGION • Bratislava city forests, Kramerov lom quarry; 48°10' 16.40"N, 017°04'41.70"E; 191 m alt.; 27.IV.2020; individual collection near a small brook; 1♂, pinned, UZSAV 344.

Identification. The genus *Riponnensia* Goeldin & Speight, 1994 is represented in Europe by five species, but only two species extend to Central Europe. *Riponnensia splendens* has an oval postpedicel in contrast to *R. longicornis* (Loew, 1843) in which the postpedicel is elongated (Bot et al. 2023).

Family Conopidae

***Zodion nigratarsis* (Strobl, 1902)**

Figures 22, 23, 25A

Material examined. SLOVAKIA – BRATISLAVA REGION • Čunovo, Celiny; 48°01'48.60"N, 017°04'45.10"E; 133 m alt.; 4.VII.2023; M. Semelbauer leg.; individual collection on flower of *Onopordum acanthium* L., grassy field, 1♀, pinned, UZSAV 345.

Identification. The genus *Zodion* Latreille, 1797 is represented in Slovakia by two species: *Z. cinereum* (Fabricius, 1794) and *Z. notatum* (Meigen, 1804). However, Mei and Stuke (2008) considered these two species as synonyms. *Zodion nigratarsis* can be easily distinguished from the latter by its distinctively larger size, orange antennae, palps, femora, and most of the tibiae. *Zodion cinereum* has at least the apex of the antennae brown, brown palpi, and darkened legs (Mei and Stuke 2008).

DISCUSSION

Bombyliidae. *Apolysis szappanosi* is a recently described species. It was first mentioned as “*Apolysis* sp.” by Papp (2003) and described shortly after (Papp 2005). Since then, it has been recorded in Poland (Mielczarek 2019). This species' biology is unknown; adults visit flowers of *Gypsophila* L., *Euphorbia* L., *Anthemis* L., *Pilosella officinarum* Vaill., and *Senecio vulgaris* L. (Papp 2005; Mielczarek 2018). *Apolysis szappanosi* occurs in sandy habitats with sparse vegetation, and known sites in Slovakia conform to this characterization. Two sites (Záhorie Military training Area and Marcelová) are covered with well-preserved psammophytic vegetation, but other sites include fallows, mown meadows, and ruderal habitat in an urban setting. *Anthemis* sp. and *Potentilla* sp. are relatively

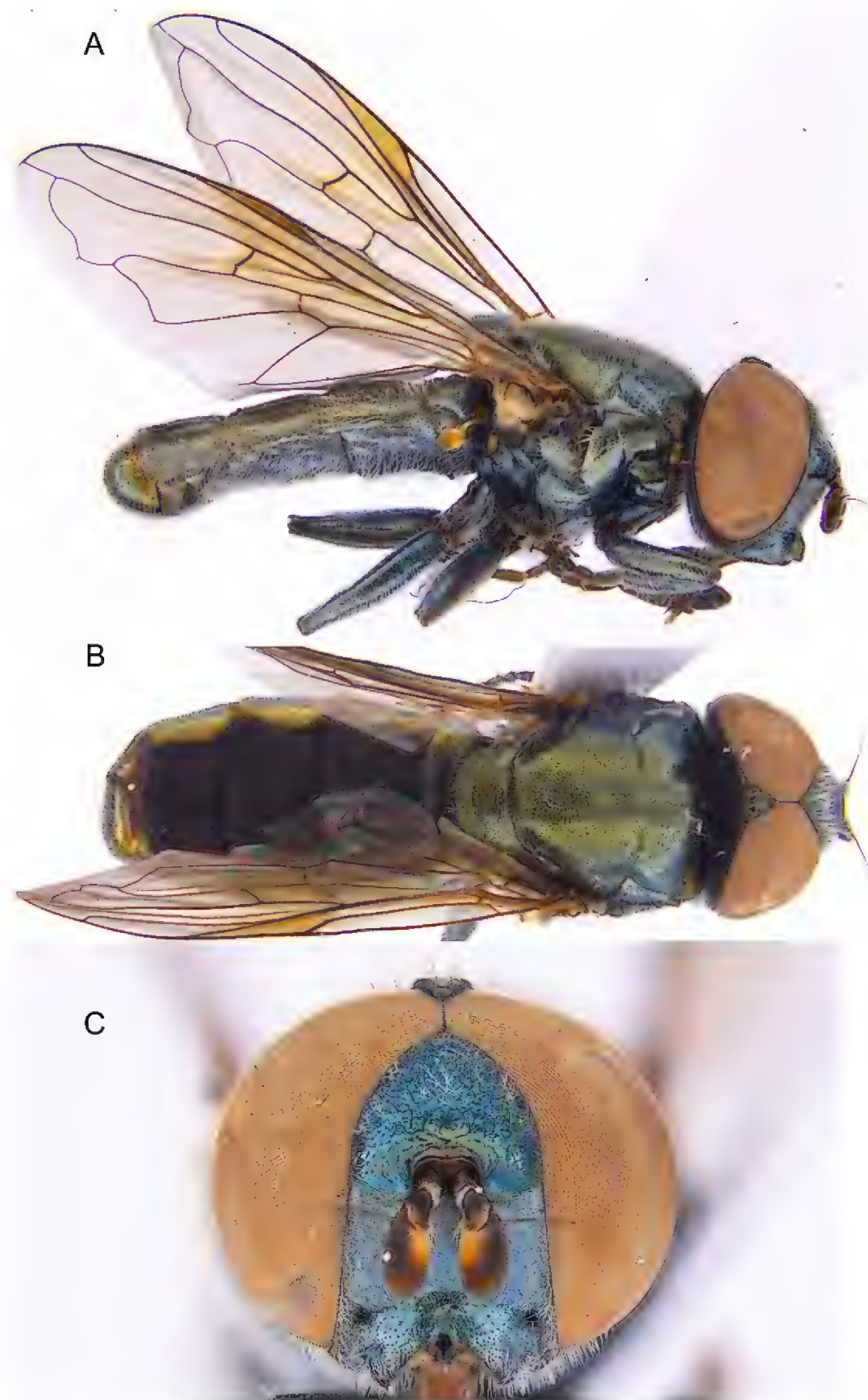


Figure 20. *Riponnensia splendens*, male.
A. Habitus, lateral view. **B.** Habitus, dorsal view. **C.** Head, frontal view.

Figure 21. Geographic distribution of *Riponnensia splendens* in Central Europe. Known occurrence (red circle). New records (green circle). Data from: iNaturalist (2024e), Tóth (2011).





Figure 22. *Zodion nigratarsis*, female. **A.** Habitus, lateral view. **B.** Head, frontal view.

Figure 23. Geographic distribution of *Zodion nigratarsis* in Central Europe. New records (green circle).



abundant in all locations. Our observations suggest that *A. szappanosi* does not have strict requirements on the quality of the habitat, but it only requires sandy soils and the presence of suitable species of flowers.

Bombylisoma unicolor is widely distributed Western Palaearctic species. Within Europe it is known mainly from Southern Europe, but it also occurs in Ukraine and Hungary (Evenhuis and Greathead 2003) and currently appears to be fairly common across western Slovakia. The species was recorded from a wide array of habitats, often with low vegetation cover: ruderal sites, landfill, fallows, urban lawns, and dry calcareous grasslands. Prokop (2024) observed the species visiting flowers of the Field Binweed (*Convolvulus arvensis* L.). The fairly high number of known sites from Slovakia contradicts Tóth (1977), who considered the species to be very rare and listed it only from one site (Hejőbába); Tóth mentioned one old literature record from 1938. However, there are no recent data on bee flies of Hungary, and it is possible that the species has considerably expanded since the time of Tóth's (1977) work. This species was also recorded in the Czech Republic in 2019 (Čelechovský and Čelechovský 2023). *Micomitra stupida* (Rossi, 1790) was also listed from single site in Hungary (Tóth 1978), but was recently recorded from both Slovakia and two regions of the Czech Republic (Čelechovský 2019a, 2019b) and is now known from a range of sites across western Slovakia (Semelbauer and Čelechovský personal data). A similar trend of gradual expansion of species can also be observed in *Exoprosopa minos* (Meigen, 1804), which was recorded in other localities in southern Slovakia and the Czech Republic in recent years (Čelechovský 2007, 2009; Čelechovský et al. 2022).

Lomatia lachesis is a western Palaearctic species known from all neighboring countries of Slovakia (Evenhuis and Greathead 2003). The biology is unknown, there is a single record of genus *Lomatia* as ectoparasitoid on larvae of Tenebrionidae (du Merle 1975). The species was recorded on dry calcareous grassland and eolic sands. It was also found in places with sparse vegetation with *Thymus serpyllum* L. (Čelechovský 2013).

Mythicomyiidae. *Platypygus bellus* is distributed in Armenia, Azerbaijan, Greece, Georgia, southern Russia, and Turkey (Gharali et al. 2013). It was discovered in Hungary only in 2002 (Papp 2003), and our record from Slovakia represents the northernmost record of this species within Europe. Within the Pannonian basin, the species inhabits eolian sands. Its biology is unknown. Despite intensive search, we recorded only a single site in Slovakia. The species appears to be present in low, flowery vegetation with *Gypsophila* sp.

Syrphidae. Both *Callicera aurata* and *Callicera spinolae* are Western Palaearctic species known mainly from Southern and Western Europe. While *C. aurata* may have been overlooked in Central Europe, likely misidentified as *C. aenea* (Král and Mazánek 2023), the more thermophilous *C. spinolae* seems to be spreading to the north due to climate change. Our records from Slovakia represent its new northwesternmost distribution limit, but see Reverté et al. (2023) for this species' distribution in Europe. Larvae of both species develop in water-filled holes in deciduous trees in overmature forests of such trees as *Quercus* L., *Fagus* L., *Fraxinus* Tourn. ex L., and *Populus* L. (Speight 2017). Although both these hoverfly species are largely arboreal, adults of *C. aurata* have been reported to visit flowers of *Crataegus* L., *Filipendula* Mill., *Rosa* L., and *Rubus fruticosus* L.; adults of *C. spinolae* have been observed visiting flowers of *Angelica* L., *Hedera* L., and *Solidago* L. (Speight 2017). Our records of *C. spinolae* confirm this species' occurrence on flowering *Hedera helix* L. and also add *Achillea millefolium* L. to plants frequented by it. Both species are considered Vulnerable in the European Red List (Pennards 2021a, 2021b).

Eumerus hungaricus is a rare but fairly widespread European species and occurs in Central Europe, where it is known from Austria, Hungary, and Ukraine. However, most records originate from southern Europe (Reverté et al. 2023). Consequently, our new record from Slovakia lies at northern edge of its geographic distribution. Adults occur on open ground and in dry oak scrub with sparse vegetation (Speight 2017). Adults have been

Figure 24. Habitats of bee-flies. **A, B.** Malacky, habitat of *Apolysis szappanosi* and *Platypygus bellus*. **C.** Virt, border between horse pasture and fallow, habitat of *Apolysis szappanosi*. **D.** Calcareous grassland near Dolný Lopašov, habitat of *Lomatia lachesis* and *Bombylisoma unicolor*.



Figure 25. Habitats of thick-headed fly (A) and hoverflies (B–F). **A.** Celiny fields, Habitat of *Zodion nigratarsis*. **B.** Pannonian grove in Šúr nature reserve, habitat of *Myolepta potens*. **C.** Sand dune near Virt, habitat of *Eumerus hungaricus* and *Paragus tibialis*. Habitats of *Callicera* species (D–F). **D.** Castle park Malacky, habitat of *Callicera aurata* and *C. spinolae*. **E.** Flowering ivy overgrowing the park's boundary wall, where *C. aurata* and *C. spinolae* were observed. **F.** Habitat of *Callicera spinolae* near Chrámec. Photo credit Marek Semelbauer (A–E) and Jindřich Roháček (F).



reared from larvae in bulbs of *Narcissus confusus* Pugsley in Spain (Ricarte et al. 2017). Apparently, other host plants must be used elsewhere. The species is classified as Endangered in European Red List of hoverflies (Vujić et al. 2022).

Myolepta potens occurs in Europe and Turkey. This species prefers mature *Fagus* and *Quercus* forests, where larvae can develop in rot holes (Reemer et al. 2004). We observed the single male of this species sitting on large broken branch of old hollow field maple within the Šúr nature reserve, part of the Pannonian woodland. The Pannonian woodland is a former wood pasture and since the reservation declaration, the grazing of cattle has ceased. After decades of spontaneous succession, part of the original wood pasture was restored. The tree cover has been thinned out, and the area has been lightly grazed by cows since 2017 (Purkart 2023). Current management should be able to preserve old trees and suitable habitats for many saproxylic insects, including *M. potens*.

Paragus tibialis is widely distributed species known from most European countries including all neighboring countries of Slovakia. It is very similar to other species of the subgenus *Pandasyohptalmus* Stuckenberg, 1954 and could be easily confused with *P. constrictus* or *P. haemorrhous* (Speight 2017). Čepelák et al. (1986) mentioned that *P. tibialis* was “abundant” at six sites and, in contrast, that *P. haemorrhous* was “rare” at two sites. In all checklists of Diptera of Slovakia, *P. tibialis* has been excluded, presumably because Čepelák et al. (1986) confused the two species. All revised material from Slovakia was later recognized as *P. haemorrhous* or they were females (Mazánek personal communication). Therefore, we provide here the first reliable record of *P. tibialis* from Slovakia. *Riponnensia splendens* is a widely distributed western Palearctic species, very sparsely and locally occurring in Central Europe. Adults occur near streams in forest, where they visit yellow composites and white umbellifers and their larvae develop in shallow water with mud and woody debris (Speight 2017).

Conopidae. *Zodion nigratarsis* is Palearctic species, which in Europe is only present in the Balkan and Apennine Peninsulas and Russia (Stuke 2017). The record from Slovakia is well outside of its known range and represents a new northernmost occurrence of the species. The observed individual was sitting on a flower of *Onopordum acanthium* L. on warm summer day; the landscape matrix consisted of large blocks of fields. We observed this individual at the edge of a fallow, which was created to support the Great Bustard and the Red-footed Falcon as part of LIFE project (LIFE STEPPE ON BORDER, LIFE 20 NAT/SK/001077).

Conclusion. Altogether, we increased the number of flies known from Slovakia by 11. Of these, three are bee flies, one is a micro bee fly, six are hoverflies, and one is thick-headed fly. The common feature of our finds is that they

have shifted the range boundaries of most species northward, at least within the Pannonian basin. At least in large, conspicuous, and presumably mobile species, such as *Callicera spinolae* or *Zodion nigritarsis*, we consider the finds of these species to be the result of recent geographical expansion possibly caused by climate change. In this respect, the occurrence of *Platypygus bellus* remains enigmatic. Within western Slovakia, eolian sands occur in the Záhorie Region near Austria, as well as in the Danubian Lowland near Hungary. In sand dune near Virt in the Danubian Lowland, intensive entomological research was undertaken using five Malaise traps in 2018–2019. We note that three species reported here were recorded in Virt, but *P. bellus* was recorded only in the Záhorie Region. If the presence of *P. bellus* was a result of recent expansion, we would expect it to be present in one of several eolian sand dunes in the Danubian Lowland, which are very close to state border with Hungary. However, this scenario is still possible for *Apolysis szappanosi*.

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Additional information

Conflict of interest

The authors declare that no competing interests exist.

Ethical statement

No ethical statement is reported.

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Data availability

All data that support the findings of this study are available in the main text.

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